

REMARKS

Favorable reconsideration and allowance of the claims of the present application are respectfully requested.

Before addressing the specific grounds of rejection raised in the present Office Action, applicants have added new Claim 28 which is derived from Claims 1, 8, and 10. Applicants observe that in new Claim 28, applicants have specifically recited that the Co layer further includes an additive in an amount from 0.1 to about 40 atomic percent. The recited additive is selected from the group consisting of Al, Si, Sc, Ti, V, Cr, Mn, Fe, Cu, Y, Zr, Nb, Rh, In, Sn, La, Hf, Ta, W, Pt, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, So, Er, Tm, Yb, Lu and mixtures thereof.

In addition to support found in Claims 1, 8 and 9, the Examiner's attention is directed to paragraphs 0027 and 0028 of the originally filed application.

Since newly added Claim 28 is supported by the originally filed application, entry thereof is respectfully requested.

In the present Office Action, Claims 1-17 are rejected under 35 U.S.C. § 103 as allegedly unpatentable over the combined disclosures of Applicant's admitted prior art ("AAPA"), U.S. Patent Application Publication No. 2002/015170 to Maex et al. ("Maex et al.") and U.S. Patent No. 5,952,094 to Van Kestersen et al. ("Van Kestersen et al.").

Applicants respectfully submit that the claims of the present application are not obvious from the combined disclosures of AAPA, Maex et al. and Van Kestersen et al. since the applied references do not teach or suggest the claimed processing steps recited in Claims 1 and 17. Specifically, the combination of applied references does not teach or suggest a method of forming a (Co, Ni) disilicide on a SiGe containing substrate, wherein

the presence of Ni (in a content up to 40 atomic percent in the Co layer) provides a *reduction of up to 120°C in the formation temperature of the disilicide as compared to a Co layer not containing said Ni, yet Ge is expelled from the disilicide layer.*

Applicants submit that the formation of Co silicides on SiGe-containing substrates that include Ge atoms is *difficult* for the reasons discussed in the background section of the instant application. As stated in the instant background section of the present invention, the presence of *Ge atoms significantly increases the formation temperature of the silicide* being formed. The applicants have unexpectedly determined that when a Co layer including up to 40 atomic percent Ni is employed a reduction in silicide formation temperature (up to 120°C) can be obtained, while expelling Ge from the resultant (Co, Ni) disilicide.

Applicants refer to paragraph 0041 of the originally filed application wherein it is stated that:

“The increase of the formation temperature above that of pure CoSi_2 on poly-Si (at approximately 600°C) can be explained by classical nucleation theory, in which the immiscibility of Ge in CoSi_2 raises the nucleation barrier for CoSi_2 on SiGe containing substrates pushing the formation to higher temperatures. Since the Ge can be in solution with CoSi (the first Co silicide phase to form during the first anneal of the silicide process) but not in solution with CoSi_2 the Ge will need to be expelled from the CoSi_2 grains requiring additional energy hence higher formation temperatures. **The addition of Ni to the Co reduces the nucleation barrier and thus the formation temperature of the (Co, Ni) Si_2 solid solution.** The reaction shifts from a nucleation controlled mechanism to a diffusion controlled mechanism reducing the temperature of formation.”
Emphasis added.

Applicants thus submit that they have expectedly discovered that Ni can be used to reduce the nucleation barrier and thus the formation temperature of the (Co, Ni) Si_2 solid solution formed.

Applicants observe that in AAPA it is shown that the formation temperature of Co disilicide on a Ge-containing substrate is too high due to the presence of Ge in the reaction region, which inhibits the nucleation of Co disilicide. Applicants find no teaching or suggestion in AAPA, which indicates a means for reducing the silicide formation temperature on Ge-containing substrates.

Maex et al. does not alleviate the above problem in AAPA since the applied secondary reference teaches the silicidation of Co on a *silicon substrate*. Applicants observe that the applied secondary reference does not teach, suggest or insinuate that the silicon substrate can be replaced by a SiGe-containing substrate. Thus, the silicide process disclosed in Maex et al. is for forming a Co silicide on a Si substrate, not one including Ge atoms as presently claimed. Applicants submit that the combination of AAPA and Maex et al. at best would lead one skilled in the art to replacing SiGe-containing substrates with silicon substrates and forming the Co silicides disclosed in Maex et al. on the silicon substrate.

Applicants further submit that Maex et al. provides no guidance as to whether their disclosed technology can be successfully employed on SiGe-containing substrates. The fact that SiGe-containing substrates are not mentioned in Maex et al. indicates that they were not aware that the disclosed processing could be employed in forming Co silicides on anything but a silicon substrate.

Applicants further observe that the fact that Maex et al. discloses that the presence of Ni (in amounts as high as 100%) accelerates the formation of CoSi_2 on a silicon substrate does not lead to the conclusion that the same would occur on a SiGe-containing substrate since the presence of Ge atoms typically inhibits silicide nucleation. Applicants

thus find no motivation in Maex et al. that would lead one skilled in the art to believe that the use of Ni could be used in the claimed manner to reduce the formation temperature of a Co silicide on a SiGe-containing substrate.

Van Kesteren et al. does not alleviate the above defects in either AAPA or Maex et al. since the applied tertiary reference also does not teach or suggest forming Co disilicides on a SiGe substrate. Van Kesteren et al. relates to magneto-optical recording medium comprising a substrate on which a magneto-optical recording layer is provided in the form of a multilayer having an easy axis of magnetization extending perpendicularly to the plane of the layer, said multilayer are composed of layers of a first type which contain predominantly Co and layers of a second type which contain a metal other than Co, said layers are alternately provided. Applicants observe that Van Kesteren et al. discloses adding Re to a Co layer to reduce the Curie temperature and magnetization, but this has nothing to do with the claimed invention.

Applicants further note that none of the applied references indicate that their disclosed processing can fabricate an interface between a Co disilicide and a SiGe-containing substrate that is smoother than a CoSi₂ interface, as presently claimed.

The § 103 rejection also fails because there is no motivation in the applied references which suggest modifying the disclosed methods to include the various elements recited in the claims of the present invention. Thus, there is no motivation provided in the applied references, or otherwise of record, to make the modification mentioned above. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art

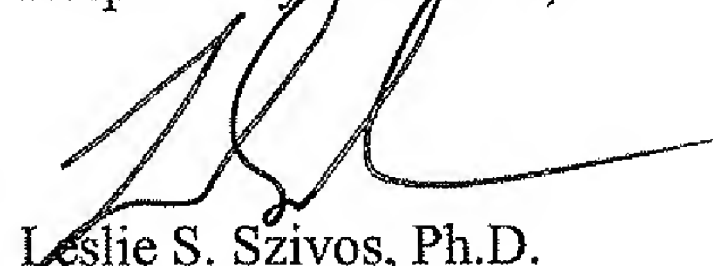
suggested the desirability of the modification." In re Vaeck, 947 F.2d, 488, 493, 20 USPQ 2d. 1438, 1442 (Fed.Cir. 1991).

The rejection under 35 U.S.C. § 103 has been obviated; therefore reconsideration and withdrawal thereof is respectfully requested.

Applicants respectfully submit that the combined disclosures of AAPA, Maex et al. and Van Kesteren et al. do not teach or suggest the alloying additive presently recited in newly added Claim 28.

Thus, in view of the foregoing amendments and remarks, it is firmly believed that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'LS', with a long horizontal flourish extending to the right.

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